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## OUR DUTY TO THE FUTURE

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**I**N a certain western city a prominent portrait photographer has for many years used the slogan, "Preserve the Present for the Future." While his chief work, naturally, has been the preservation of the likeness of human beings, his advertising contains an appeal to the sentiment of his patrons that might well be the sentiment of all of us toward every worthy product of human endeavor.

There may be found in this slogan the germ of an idea that appears to have been given but slight consideration in our present age of hurry and worry, hustle and bustle, strain and stress. This idea may be expressed broadly as the desirability of making some definite effort to preserve our present-day knowledge, along with the best products of man's hand and brain, in a form that will endure as long as the Pyramids, or even much longer. With our present scientific knowledge and spirit, the glories of this age ought to be recorded and made intelligible to posterity in a manner that could be equalled or surpassed only by posterity. There should be a concerted effort and aim of living civilized men to preserve a representative portion of the present for the future.

There are probably few men in the scientific world who do not think it well worth while, and even necessary, to take an interest in some branch or branches of science outside of their own specialties. One may go even further and say that many scientific men take more or less interest in all sciences. While it may be nothing more than a guess, yet it may be stated as a probability that the majority of the readers of **THE SCIENTIFIC MONTHLY** belong to this latter class. If this is true, or even half true, it may be assumed that this article is addressed to a considerable number of men who are interested to a greater or less degree in the fascinating science of archeology.

The ephemeral, transient character of most of the present works and products of man is readily noted. What bearing will this fact have upon the future? Any person who is familiar with the work of the many enthusiastic, patient and long-suffering archeologists of the last sixty years will recall the problems and difficulties which have harassed these workers. While many most interesting and noteworthy discoveries have been made, they have cost much money, time and labor, and the best years of many worthy men. Let us ask ourselves if it is right that we, with our costly experiences in attaining what is at best but an imperfect knowledge of ancient civilizations, should be indifferent as to

the records we leave, or the lack of them. Is there not a possibility that the archeologists of the future will find it proportionately as difficult to obtain an accurate knowledge of our present civilization as our present archeologists have found it to learn about the past? It may be worth while to consider what our duty is in this respect to posterity.

In this discussion we may find it convenient to indicate the modern products of man's hand and brain, that have at present a permanent or recorded form, as "works." Those of the past might be referred to collectively as "ancient works." Before we proceed further in our argument, it might be well to examine the modes in which the works of man may be or have been destroyed. And by destruction we mean the state of ruin in which we have found many ancient works, as well as the utter ruin which leaves practically no trace or residue.

Most of the natural forces that appear to have accomplished the ruin of ancient works can be considered as being just as effective now as they have ever been. Possibly we should still consider man as an intentionally destructive agent, present world conditions being so closely analogous to those of the past.

The first natural agent that probably most readily suggests itself is vulcanism, with its accompanying or brother calamity, earthquake. One scarcely needs to enlarge upon the series of disasters of this character that have occurred within historic times. Nearly every year we still find that earthquakes and volcanic eruptions occasion great damage and loss of life somewhere on the earth. If a building is to withstand earthquake, it must be exceptionally well built, and its site and foundation prepared with some care. Or, on the other hand, the buildings have to be, like those in Japan, constructed of materials that may be destroyed by other agents, if not by earthquake. Vulcanism may be terribly destructive in several ways. One is by the burial of cities beneath great quantities of volcanic "ash," sand, lapilli, etc., as at Pompeii; another, by the flow of hot lava over and through the works of man; still another, by the swift discharge of large volumes of hot and poisonous gases, as at St. Pierre. One might almost say that more ancient ruins were caused by earthquake and vulcanism than by any other natural means.

Considering wind, water and fire, one may readily recall the known effects of these natural agents upon ancient works. Violent winds or tornadoes have doubtless visited man's habitations in the past as they have in modern times, and in their effects have been as destructive to certain structures as fire or earthquake. The Deluge of Biblical history seems to have been something more than a mere tale. Even the legendary continent of Atlantis may have existed as a large island or archipelago, finally destroyed by tidal waves and seismic disturbances. Floods and deluges are prominent in the folk-lore of peoples over nearly the whole earth. We moderns have had experiences with floods, tidal waves, and the like, which have shown us the destructive power of

water, and its sudden and unexpected attacks. The past has witnessed many an ancient work ruined or damaged by water, and here also the hand of nature was seen more often than that of man. On the other hand, destruction by fire has doubtless been occasioned much more often by man than by nature. Whether started by accident or by design, fire has ever been a terror to all peoples. While many ancient works were of a character to remain to a large extent unaffected by fire, yet some of the things most desirable for us to have known about were utterly lost, being readily combustible. It is certainly fortunate for us that such a large number of written records were made on stone, clay or metal instead of on so combustible a substance as papyrus. What would we not now give for manuscripts long since destroyed, as those in the famous library at Alexandria, or the Aztec writings burned by fanatical Spaniards? We are able to see, then, how these agents, the primitive elements, air, water and fire, have affected man's works in the past, and what may be expected of them in the future.

Still other natural forces deserve our attention. Among the most prominent of these are the two extremes, glacial and desert conditions. The destructive action of ice and snow is to be seen somewhere almost every season on a relatively small scale. But what of a frigid epoch like that of the Pleistocene when half a continent was covered with immense ice sheets? We only have to be reminded that in those times the destruction of nature's own works was enormous, in order to realize what might have happened to ancient works, and what may yet happen to our own works of to-day. Whether acting as glacier, iceberg or floe, ice must be reckoned with as a possible natural agent in destroying the so-called "imperishable" habitations and monuments of man. And with ice we must put the avalanche, a swifter but less powerful ally. One might also speak here of landslides, an agent of destruction that is not at all unfamiliar in many parts of the world.

The desert areas of the globe afford us some excellent examples of the effect of torrid and arid conditions upon man's works. The deserts are quite frequently areas of violent atmospheric disturbances with almost an entire lack of precipitation and consequent dearth of vegetation. The soil is sand, or alkali, or a mixture of these, and the winds keep the small dry particles in almost constant motion. Rock surfaces are soon cut, etched, and eroded to an astonishing degree by the force of nature's sand-blast. Is it surprising that there are but few inhabitants, and these mostly nomadic, in the desert places? Yet on the sites of several present desert regions there flourished in ancient times civilized peoples whose only relics that remain to us are a few ruins of stone buildings, a few mummies, some specimens of pottery, and a few metallic ornaments. The present Sahara desert was in recent geologic times the home of animals that subsisted upon abundant vegetation. The Desert of Gobi has overtaken and concealed cities

of the ancients, of which little remains but a few ruined walls. The coast of Peru, possibly as rainless a region as may be found, has beneath its sands the remains of a people of unknown antiquity. The remarkable ancient city of Petra is situated in a peculiar many-colored rock-walled valley in the midst of a desert. It was wholly lost to the world for over a thousand years. On our own Atlantic coast, and elsewhere, we can readily follow the sand dunes as they travel inland, burying and destroying forests and villages. The known work of the wind, aided by sand, especially in a rainless, tropical region, suggests a natural agent of destruction—an enemy of man's handicraft that may be expected to certainly overtake and destroy, somewhere, sometime, the objects of art and culture that modern man has so carefully and painfully constructed.

Finally, we might make mention of the part man has taken in accomplishing the destruction of the works of his brother. War, disease, pestilence, the torch, starvation, and like allies of savage man, have wrought great destruction of material things, either directly or indirectly. The effects of fire have been referred to. War, hand in hand with disease and starvation, has leveled and depopulated many a city and country, and most often the victors in war have removed their loot and carried off their slaves, leaving the works of the vanquished people to lie uncared for and in ruins. Sometimes the fortunes were reversed, where a race or tribe of people who had been taken captive eventually carried out a successful rebellion, returned to the sites of their former cities, conquered or drove away any foreign race, and built their cities anew. In the course of time these cities were cast down in ruins once more.

Innumerable questions arise in the tracing of the fortunes of many peoples whom we moderns know only by the ruins and relics we have found. When we inquire into the reasons for the disappearance of a people, or the discontinuance of their civilizations, we can not always be sure that the proper agent or agents have been selected, since in the end the effects of several different agents may be so similar. Who were the Mound Builders, the Cliff Dwellers, the Toltecs, the Mayas, the Pre-Incas, the Cambodians, the mysterious dwellers of Easter Island? What was the origin of each of these peoples? In most cases we do not even know when or why they disappeared, much less their history. Were they exterminated or forced to migrate by natural agents, or by a conquering race? Have their works fallen to decay as a result of nature's behavior, or has nature been assisted by the hand of man? Doubtless, these and all similar questions will be fully and definitely answered sometime. But are we to wait until that time arrives before we are moved to consider the history of these and all such races, and learn one of the most serious lessons such consideration has to teach us?

Our present-day museums contain many wonderful, curious, instructive and interesting objects. The museum is a real factor in education, and the vast amount of labor and money spent on these treasure houses of art, history, science and industry has been in most instances well spent. Further, the value of the exhibits and collections has increased with the passage of time. In fact, it is almost axiomatic that the further we become removed in time from the moment of its fashioning the more valuable an object becomes. In but few instances, however, can we be said to be taking definite action to "preserve the present for the future." We have by great diligence acquired some knowledge of man as he lived before our time, with some of his relics, monuments and works of art. We take great pains to transport and preserve Egyptian obelisks and tombs, Babylonian inscriptions, Aztec gods, and even Libby prisons and presidential birthplaces. What is the future of these? Will the coming generations fail to receive or acquire an interest in these things equal to our own? It would seem probable that there will be men five or ten centuries hence who will have an interest in not only their own national history, but also that of peoples who seem ancient or semi-ancient to us. It would seem that our duty to the future lies in not only preserving our own present-day relics, but also in leaving some adequate and authentic account of our own times with such illustrative material as may be considered necessary or desirable.

It seems almost needless to point out that we ought to be beyond leaving our records and relics to the future in any indefinite or haphazard manner. Yet if we ask ourselves what we have done or are doing to safeguard our historical treasures and works of art, what answer is to be found? Have we taken into account the possibilities? Suppose this country should be visited by some unprecedented and widespread series of disasters, originated by the forces of nature—what would be left? What is there that we now have that could withstand earthquake, vulcanism, tornado, tidal wave, fire, ice or sand dune? Suppose our museums and monuments escape one or several of these destructive agents, are they able to withstand all? What is there that we may really call permanent, that we may set up to defy all the forces of nature until the next geologic era?

Let us see if among the present known materials there may be found one that we may call the ideally resistant material. The rocks of the earth's surface have always appealed to man as the very essence of endurance, changelessness and permanence. In the stone age man learned that some rocks were very hard, dense and durable; that others were soft or brittle; that some rocks could be shaped by using pieces of harder ones, and polished by the powder of others; that some were adapted to the fashioning of weapons and implements, idols, inscriptions, and ornamental designs; that rocks resisted fire and the weather,

and afforded a shelter from heat, cold and storm, and a barrier to enemies. While man has since learned the manufacture and uses of other materials, he still seems to place his greatest faith in stone as a means of combining dignity, utility and permanence. The most famous and nearly the most ancient stone monuments are the Pyramids of Egypt. They have endured so long as to seem almost indestructible. But let the climatic conditions be altered to correspond with central Africa, or even the interior of the Sahara, and the Pyramids would be much less able to resist the forces of nature; their period of duration would be greatly shortened. Earthquake is perhaps the greatest destroyer of structures in stone, yet man has learned how to build, if he will, so as to withstand even violent earthquake shocks, as evidenced by the wonderful mortarless masonry of the Incas, in Peru, a land that certainly can not be said to be free of the peril of earthquake. Reinforced concrete is probably the best modern material that might be used to withstand earthquake shocks. The concrete work at Panama, a region that has seen considerable seismic disturbance, will probably afford us information as to its stability in due time.

It might be remarked in this connection that reinforced concrete seems to suffer but little from the effects of fire, unless the heat be exceptionally intense and prolonged. Many rocks, however, do not pass the ordeal of fire without becoming thereby more readily attacked by weathering agents. Granite, marble, limestone and sandstone, four of the most used building stones, endure heat rather unequally. Both marble and limestone are decomposed by heating, passing into ordinary lime. Digressing for a moment to the use of marble in ancient art, we are frequently struck by the lack of foresight, or of knowledge, of the ancient as well as medieval and some modern sculptors in choosing marble as the final expression of their art. Pure white marble is undoubtedly beautiful; but, supposing some vandal desires to satisfy his appetite for destruction by pulling down marble statues, shattering them by blows, or forever destroying them by fire? Modern artists never cease grieving over the incompleteness of many of the ancient masterpieces, known to us only in a fragmental or damaged condition.

Granite and sandstone may successfully withstand earthquake and fire, but they, as well as less stable rocks, can not be entirely free of the effect of vulcanism. The well-known effect of molten lava upon sandstone, changing it to quartzite, would be the final chapter in the history of an edifice of sandstone, overtaken by a lava flood. And in the case of either granite or sandstone, a lava flood would so fill and surround and alter the structure that it would be as good as lost forever. The earthquake and volcano belts of the earth have been carefully traced and defined, and are found to be practically identical in position. The association of earthquakes with volcanoes is very striking; but are we quite certain that these belts will always remain as they

are? Is there not a possibility of their shifting, very gradually perhaps, but nevertheless with a distinct movement, noticeable every fifth or tenth century? The question is one that can not be definitely solved. The belts will doubtless move together, but can we say that any given portion of the earth's crust will be forever free of earthquake or vulcanism?

Man seems to delight in building his cities as near to danger as possible. Witness the manner in which the peoples of the Mediterranean insist on staying by their volcanoes, and rebuilding their shattered cities. Taking an example at home, may not San Francisco run the risk, with other coast cities, of being destroyed once more, or possibly several times, by earthquake? The archeologists of the future may find several buried cities on the present site of San Francisco, if man insists on living at that point as the Pacific coast littoral becomes broader, and the Sierras rise higher to the accompaniment of unnumbered quakings and tremblings.

But even though stone, the favorite building material since prehistoric times, is able to survive or be spared the effects of earthquake, fire, vulcanism and flood, it is still subject to final and complete disintegration through the slow but continued action of the weather. Wind, rain, frost, the gases of the air, and even the humblest living organisms combine to overthrow that which man has erected, and which may have withstood all other destructive agents. In this respect granite is almost as unstable as the other varieties of building stones mentioned. The coarser the grains in a granite rock, the more easily the rock crumbles. It is readily split or fractured by frost, by trees, and even by the heat of the sun. Limestones and marbles are slowly dissolved by the carbon dioxide in rain and in percolating waters. If in contact with soils and vegetation, a similar effect is observed, due to the same cause. Sandstones may resist the effect of frost, rain, and carbon dioxide, but succumb at once to the chiseling effect of sand particles driven by the wind. Running water is often more active than wind, rain or air in disintegrating and pulverizing rocks; while a glacier either moves bodily whatever comes in its path, or rides over it and crushes it to the finest powder. After reviewing thus the effects of the principal destructive agents upon stone, to put our faith in stone as the sole protection to our treasures of the past and present would seem to be open to several objections.

Next to stone, we find man has discovered and placed a value upon certain substances which he has learned to call metals. At the present time we may be said to be living in the age of steel. Iron is our most important metal as it is the most useful and most abundant, or rather, is the cheapest and is most readily obtained in large quantities. Yet iron is the most perishable of all metals. Rust is the chief enemy of

all our iron and steel objects. To avoid rust has been the aim of man ever since he discovered iron and its uses. When quite pure, the rusting of iron is greatly retarded, but it is scarcely possible to indefinitely defend even pure iron against rust. Fire, sea-water, and ice, as well as the weather, could destroy a structure of iron in the course of time, and even in much less time than it would take the same agents to destroy a structure of stone. When properly imbedded in concrete, however, iron or steel not only adds greatly to the strength of the concrete, but is very much less liable to rust, owing to the protective effect of the cement.

If iron is of doubtful permanence, will other metals or alloys serve better? Undoubtedly some of them might, to a certain degree. Bronze is surely very resistant to the weather, as are its components, copper and tin. These, however, could be readily melted in a fire, as could zinc, aluminum and lead. Gold and silver are even more resistant to corrosion and high temperatures, but their cost prevents their extensive use. The same is true of platinum, tungsten, vanadium and still rarer metals. We can scarcely choose a single metal that will serve as an ideally resistant agent or material and at the same time be of practical use.

Clay products often appeal to us as having singular powers of resistance to certain destructive agents, but in all cases such products are found to have some fatal weakness. While quite resistant to the weather, and to a certain degree of heat, yet severe weather conditions or intense heat may destroy them. In most cases the practicable forms of these products are brittle, and for that reason are readily damaged. Ancient inscriptions in clay have been preserved for a very long time, and are of great interest and importance in archeology, but we should remember that the destructive agents directed against them did not include severe weather conditions nor high temperatures.

Possibly the most resistant mineral substances that appeal to modern man are asbestos and its allied minerals, talc, steatite and serpentine. These lend themselves readily to the shaping of numerous articles. Asbestos in particular is very familiar to us in its uses as a fire-proofing material and non-conductor of heat. Softness and brittleness, however, are objectionable properties of most products from these minerals, just as brittleness is a characteristic weakness of kaolinite or clay products.

Glass, while hard and resistant to the weather, is too readily injured by high temperatures, and is too brittle to give us much hope in our search for an ideally resistant material. While glass is of enormous importance in our modern civilization, it seems probable that most of it will remain in its present forms only under quite favorable conditions.

If the substances so far discussed are unsuitable for the purpose of perpetuating or safeguarding our records and relics of ancient and

modern times, the natural query is, "In what way or ways may we preserve the present for the future?" Most of our historical, scientific, religious, social, political and other kinds of documents are composed of flimsy and combustible materials, on which it is easy to almost completely and permanently obliterate or efface the written or printed record. The bulk of our modern paper is less permanent than that made two and three hundred years ago, or even the papyrus of the ancients. Yet we entrust our most precious records to the surface of a substance that can not be expected to endure two thousand years under the most favorable conditions. Photographs might be better preserved in the form of the original glass plate, or a non-combustible film, or best of all, as a half-tone or similar metallic engraving. The photographic print, or the print from an engraving is certainly as perishable as the paper on which it is made. History, art, literature, science, and written knowledge as a whole, may be transmitted to posterity in the form of copies, if necessary, using the proper measures to ensure authenticity as well as safety in preserving and protecting such copies until they are to be recopied or rewritten. But what of the originals of many historic documents, photographs, and the like? Will not these relics be of greater interest and value if they, and not mere copies, are preserved for the future? Copies of certain things, particularly works of art, are not always desirable, nor can these things always be copied to the best advantage. We may admire and cherish beautiful and costly mural paintings and other decorations, but can we be certain that the buildings containing them will escape complete destruction? The beautiful Library of Congress could be hopelessly ruined by a few well-directed bombs from a fleet of hostile airships, if not by the shells from some long range naval gun. Could its art treasures, not to speak of other kinds, be successfully restored? What would happen to the National Museum, and the museums, libraries, and art galleries of our coast cities in case of war and sudden attack? Have we any adequate or efficient means of preserving the products of man's genius and inventive skill? What machines could withstand the destructive agents cited? Do these questions concern us, or do they not?

Several years ago Mr. Percival Lowell wrote as follows:<sup>1</sup>

One reflection well worth our thought the pyramids suggest: the enduring character of the past beside the ephemeralness of our day. We build for the moment; they built monumentally. True we have printing which they had not. But libraries are not lasting. Fire, accidental or purposive, has destroyed the greater part of the learning of the far past and promises to do so with what we write now; and what escapes the fire mold, may claim. Only that idea which is materially most effectively clothed can withstand for long the gnawing disin-

<sup>1</sup> *Popular Science Monthly*, Vol. 80, p. 460 (1912).

tegration of time. The astronomic thought of the pyramid-builders lives on to-day; where will record of ours be, I wonder, five thousand years hence. We may be quoted indeed with ever-increasing inaccuracy of description. . . .

What answer can we make to this? Our nation has endured and prospered for one hundred and forty years. There are reasons for supposing that it will endure for another century, or two or three or ten centuries. But nature will not be idle all this time. She moves slowly, it may be, but nevertheless most surely. Is there not something that we, who are living here and now, can do to add to the good name which we all sincerely wish, as the United States of America, to leave to posterity?

We are greatly concerned in the topic of preparedness, for war or for peace, according to the way in which we recognize our individual duties and interpret our national needs. Is it wholly out of place to suggest that we also prepare for the contest which the objects we have fashioned and which we have held to be worthy must make with Mother Nature? Why should we stop at one thousand or five thousand years as the limit of our responsibility? What of us and our descendants ten—twenty—fifty—one hundred thousand years from now? If man is still man, will he not then have as great an interest in his antiquities as we have in ours? Knowing the conditions with which our present students of archeology have to contend, are we to take no thought of the possible problems of the future? The ancient monarchs who ruled flourishing empires thousands of years before our time have in many cases done us an inestimable service in causing their names and deeds to be inscribed in the most durable form known to their art. Are we to make no use of our superior knowledge in preserving for the future, not only our collections of antiquities, but an adequate record of our own national progress and current thought?

If it may be assumed that there is a modicum of agreement on the proposition of preserving the present for the future, we may naturally begin to inquire, what is to be done, and how shall it be done? The first question raises another of much greater scope, namely, what shall be selected, in case a move is made to preserve definite things for the benefit of future antiquarians? Possibly this question could best be settled by a commission, appointed by and under the direction of the federal government, sufficiently large and representative to bring forth all sorts of views on the problem. The work of such a commission would doubtless include discussions, decisions, and investigations concerning the worth and claims of the thousands of things that would be suggested on every hand. It is true that thousands of corner-stones of public buildings all over the country contain a record of a certain kind. But how adequate would such records be? We have in the cornerstone custom a primitive attempt at leaving some sort of record for the

future, in which we are outdone many times over by the customs of the ancient dwellers of Egypt and Babylon. We may have Halls of Fame, and galleries of statues, but they are necessarily somewhat too exclusive and intangible to satisfy the desires of the archeologists of the future. We might emulate the enterprise shown abroad in preserving phonograph records of living orators, singers, and instrumentalists. But why stop there? Our modes of recording history and noteworthy events seem to be at the height of perfection, and the preservation of photographs, moving-picture films, as well as the voices of our leading national figures is to add to the future an untold wealth of interest in us and what we have done, together with a better understanding. The selection, then, of that which we ought to make an especial effort to preserve would probably be based upon the relation of the objects and records to the history, progress, culture and life of the nation as a whole. That the project should be financed and carried out by the federal government will probably be agreed to by all.

As a secondary function of our hypothetical commission there remains the necessity of determining how we shall go about it to preserve these things, once they have been chosen. Our review of destructive agents, noting what they have done and still may do, as well as the consideration of the amount of resistance to these agents possessed by our present materials, causes us to confront the problem with some degree of anxiety, since no one of the materials known to man will serve for all the requirements of the problem's solution. This phase of the movement would likewise need careful thought and discussion, and it would probably be found that only a combination of materials would satisfy the requirements.

To paraphrase a well-known quotation, we can not predict in what century the "New Zealander will gaze on the ruins of Brooklyn Bridge." Nor can we say at what moment the hand of the invader will be stretched out to destroy or snatch away our treasures. It is true that in time of war, or under threat of ruin by fire, earthquake, glacier or volcano, we could remove a portion of our works of art, our relics of state, and our rarest collections to some safer quarter of the country. But would such a move be final or satisfactory? When the Washington monument and Grant's tomb are but rocky ruins in a watery waste, what will have become of the lesser works of the nation that erected these tributes to the memory of two of their most illustrious men? Let us determine that what we do leave shall be as well preserved as the remains of the trilobites of fifty million years ago, and that our mode of preservation shall contain less of accident and more of thoughtful design. Looking forward, can we see this as a portion of our duty to the future? If we can, let us set about the fulfilment of our duty, as becomes true Americans.